

# Coronary artery bypass graft surgery in dialysis patients

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## Abstract

**Objective**—To examine the short term results and long term survival of patients on long term dialysis undergoing coronary artery bypass graft surgery.

**Methods**—A retrospective analysis of 19 patients on established dialysis who underwent coronary revascularisation between 1983 and 1995; 14 patients (73%) had class IV angina and five (25%) had unstable angina requiring heparin and nitrate infusions before surgery.

**Results**—The 30 day mortality was 5%. Follow up was completed in the remaining 18 patients. The mean follow up time was 34 months (range eight to 61). During the follow up period four patients died of cardiac causes. The actuarial survival at one, two, and three years was 87%, 78%, and 59%, respectively. The overall functional status was significantly improved compared to preoperative levels, with a mean Karnofsky score of 76% ( $p < 0.01$ ) at three years.

**Conclusions**—Coronary artery bypass graft surgery can be performed with increased but acceptable morbidity and mortality in chronic dialysis patients. It results in considerable improvement in symptoms and functional status. However, long term survival is limited and this requires further investigation.

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Myocardial infarction and other cardiac disorders remain the leading cause of death in patients with end stage renal disease.<sup>1</sup> It is reported that between 30% and 53% of deaths among long term dialysis patients are due to coronary artery disease.<sup>2-4</sup> The European Dialysis and Transplantation Association reported that this figure has remained unchanged over a 10 year period.<sup>4,5</sup> They have also reported that the cardiac death rate in dialysis patients is 20 times higher than in non-dialysis patients. This may be because dialysis and transplantation allows previously acquired atherosclerosis to become overt,<sup>6</sup> or because of risk factors associated with end stage renal disease.

Most investigators have reported morbidity and mortality in patients requiring cardiopulmonary bypass for coronary revascularisation as well as other cardiac procedures.<sup>7</sup> Fewer studies have examined the results of coronary artery bypass graft (CABG) surgery in patients

on maintenance dialysis.<sup>8,9</sup> With increasing numbers of older patients requiring dialysis for end stage renal failure, the requirement of coronary artery bypass graft surgery in this patient population may increase. We therefore examined the outcome in patients who were on maintenance dialysis and required surgical revascularisation between 1983 and 1995.

## Methods

A retrospective analysis was carried out of all patients who were on maintenance dialysis and required coronary revascularisation between January 1983 and June 1995. Nineteen patients were identified. They had all been on dialysis for at least one month before surgery. Patients who had had a renal transplant and those who had abnormal renal function but did not require dialysis were excluded. Data were collected from the patients' medical records. Preoperative cardiac history, risk factors for coronary artery disease, and angiographic data were recorded. Symptomatic angina was classified using the Canadian Cardiovascular Society (CCS) criteria. Features of heart failure were classified according to the New York Heart Association (NYHA). The functional status was assessed using the Karnofsky score,<sup>10</sup> where normal activity is considered 100%, inability to work and requiring some help scores 50%, and requiring institutional care scores less than 40%. Significant coronary lesions were defined as those causing 70% or more narrowing of a major coronary artery, or left main stem stenosis of more than 50%. All patients had a ventriculogram.

Preoperative renal history, including the cause of renal failure, the duration of dialysis, and renal function tests, was recorded.

Coronary artery bypass grafting was performed using a bloodless prime in the bypass circuit and antegrade cold crystalloid cardioplegic solution, or intermittent cross clamp fibrillation. Perioperative morbidity and mortality were defined as occurring within 30 days of surgery. Follow up was complete in all patients. Information on this was obtained from the medical records, supplemented by telephone interviews or contact with the general practitioner. Long term survival and freedom from disease were calculated using the Kaplan Meier method.

## Results

The mean age of the patients was 58 years (range 33 to 74), with a male to female ratio of 2.5:1. Fourteen patients (73%) had class IV angina and five (25%) had unstable angina and

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required heparin and nitrate infusion before surgery. Eight patients (42%) had symptoms of congestive cardiac failure, class III or IV. Nineteen patients (78%) were hypertensive, 12 (63%) had a history of smoking, 10 (53%) had hyperlipidaemia, 11 (58%) had a positive family history of ischaemic heart disease, and seven (37%) were diabetic. Five patients (26%) had significant left main stem stenosis, 11 (58%) had three vessel coronary disease and three (16%) had two vessel disease. Twelve patients (63%) had good left ventricular function, six (32%) had moderate ventricular function, and one (5%) had a poor ventricle.

The 19 patients had been undergoing dialysis treatment for a mean of 32 months (range one to 68 months). Eleven patients were on chronic haemodialysis and eight were on chronic ambulatory peritoneal dialysis before surgery. The cause of renal failure was attributed to hypertension in 10 patients (53%), to diabetes with or without hypertension in six (32%), and to polycystic kidney disease in two (11%); one patient (5%) had Buerger's nephropathy. The preoperative mean serum creatinine was 263  $\mu\text{mol/l}$ .

Coronary artery bypass grafting was performed using cold crystalloid cardioplegia in 13 patients (63%) and in the remaining patients the method of intermittent cross clamp fibrillation was applied. The mean cardiopulmonary bypass time was 68 minutes, with a mean cross clamp time of 42 minutes. The left internal mammary artery was used in eight patients (42%). One patient had a repeat procedure and one required combined carotid endarterectomy and coronary artery bypass graft surgery.

The 30 day mortality was 5% (one patient). This was the patient who required a repeat procedure. He was a 74 year old male who had undergone coronary revascularisation with three vein grafts in 1988, four years before his second presentation. He had become increasingly symptomatic despite maximal medical treatment. He had diffuse coronary artery disease and two of his three original grafts were blocked. He underwent redo CABG surgery where the left internal mammary artery was used. Postoperatively he died of myocardial failure.

The patient who underwent combined carotid endarterectomy and coronary artery bypass graft surgery had had multiple transient ischaemic attacks. He was found to have a right sided carotid bruit which was shown on Doppler ultrasound to be caused by a significant stenosis. He underwent a combined procedure and did very well postoperatively, being discharged home nine days after surgery. Two patients (11%) were returned to the operating theatre because of bleeding. One had developed coagulopathy and one had a surgical source of bleeding. One patient (5%) developed mediastinitis and dehiscence of his sternotomy wound, which required rewiring. In this patient the internal mammary artery was not used. Another patient developed pneumonia which resolved three weeks after surgery. The average intensive care stay was

Table 1 Summary of data from the recent series of coronary artery bypass grafting in patients on chronic dialysis

Series	No of patients	Operative mortality	Length of follow up and survival
Marshall <i>et al</i> <sup>12</sup>	12 25*	1 (8%)	1 year, 83% 3 years, 69% 5 years, 48%
Opsahl <i>et al</i> <sup>8</sup>	39	1 (2.6%)	2 years, 92%
Batiuk <i>et al</i> <sup>9</sup>	25	5 (20%)	1 year, 95% 2 years, 77%
Owen <i>et al</i> <sup>10</sup>	21	2 (9%)	1 year, 84% 2 years, 45%
Present series	19	1 (5%)	1 year, 87% 2 years, 78% 3 years, 59%

\*Patients from other studies were included in the follow up because of the relatively small number of patients in Marshall's series.

two days (range one to 19 days) and the average ward stay following surgery was 10 days (range one to 20 days). Follow up was completed in all patients. The mean follow up time was 34 months (range eight to 61 months). In the follow up period four patients died of cardiac causes: one had a sudden cardiac arrest, two died of congestive cardiac failure, and one died after a myocardial infarct.

The actuarial survival was calculated by the Kaplan Meier method. The survival rates at one, two, and three years were 87%, 78%, and 59% respectively. The overall functional status was significantly improved compared to preoperative levels, with a mean Karnofsky score of 76% ( $p < 0.01$ ) at three years.

## Discussion

Patients on maintenance dialysis undergoing coronary artery bypass graft surgery are clearly different from others who undergo coronary revascularisation. Cardiopulmonary bypass causes large fluid shifts in different body compartments. In patients on chronic dialysis the handling of such large shifts is obviously impaired. In addition, dialysis patients are at increased risk of postoperative bleeding, partly as a result of platelet dysfunction and coagulation defects. They are also more susceptible to infection.<sup>4-11</sup> In the current series the 30 day mortality was 5%, the incidence of postoperative bleeding was 11%, and the infection rate was 5%. It is difficult to compare data with other series because of different inclusion criteria. Most studies have included non-dialysis patients with deranged renal function, and also transplant patients. Our figures are comparable with those of other series. Marshall *et al*<sup>12</sup> reported a mortality of 8% in 12 patients who underwent coronary artery bypass graft surgery. In the same series one patient (8%) had a sternal dehiscence secondary to mediastinitis. Data from most of the recent studies are summarised in table 1. The discrepancies in figures across different series may be due to a combination of factors, such as the duration of dialysis, the nature of the coronary artery disease, and the urgency of surgery.

In the current series, patients had very good relief of their cardiac symptoms at the time of hospital discharge. Similarly, in other series coronary artery bypass graft surgery had been

shown to be effective in the relief of symptoms of angina.<sup>13-15</sup> Some investigators have shown improvement in late cardiac symptoms after coronary bypass in dialysis patients.<sup>8,9,11,12</sup> However, the long term benefit and the impact of coronary artery bypass graft surgery on survival in this group of patients is controversial (table 1). In a study by Opsahl *et al*,<sup>8</sup> the survival in patients who underwent coronary revascularisation was better than in those who were treated medically, but this difference was not significant. In the present series the one, two, and three year survival rates were 87%, 78%, and 59%, respectively. These figures are notably lower than those for the normal coronary population, which have been reported to be 95%, 88%, and 75% at one, five, and 10 years, respectively.<sup>16</sup>

It has been suggested that patients in chronic haemodialysis have accelerated atherosclerotic disease. This has not been proven and it may be that dialysis allows previously acquired atherosclerotic disease to manifest itself clinically.<sup>6</sup> In our series a significant number of patients died of cardiac causes despite coronary revascularisation. This may have been due partly to the nature of their disease or to early graft occlusion. The other treatment option in this group of patients is percutaneous transluminal coronary angioplasty (PTCA). In a study by Kahn *et al*,<sup>17</sup> 17 chronic dialysis patients underwent PTCA over a six year period. There was one procedural death (6%), two non-Q-wave myocardial infarcts following PTCA, and one late death. The 15 survivors were asymptomatic at discharge but recurrent angina developed in 12 patients (80%) within six months. Angiography in 11 of those patients showed restenosis in 81% of the dilated sites. The investigators conclude that attempting PTCA in dialysis patients is technically successful and provides short term relief of symptoms, but cannot be viewed as definitive revascularisation.

In eight patients (42%), we used the internal mammary artery for revascularisation. There are no data to indicate whether the use of the internal mammary artery decreases long term mortality and improves graft patency and survival. This has to be weighed against the possible increased risk of bleeding and infection in this group of patients.

We did not compare coronary artery bypass graft surgery with medical treatment in this study because it was retrospective and lacked matched controls.

As far as the special management of chronic dialysis patients in the perioperative period is concerned, we recommend dialysis 24 hours before surgery. We believe this avoids any possible haemodynamic instability before bypass. Others believe that dialysis should be per-

formed as close to bypass as possible, arguing that this provides the optimum fluid and electrolyte balance at the time of surgery.<sup>18</sup> We feel that in the immediate postoperative period, dialysis is not often required and if it is we prefer to use peritoneal dialysis to avoid the need for anticoagulation. Once the patient has passed the immediate postoperative period, the usual method of dialysis is restarted.

In summary, we believe that coronary artery bypass graft surgery can be performed in dialysis patients with acceptable morbidity and mortality, with good short term results and excellent symptomatic relief. However, long term survival requires further investigations, in particular the use of the internal mammary artery as a conduit.

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